Follow Up on Return Flows

ESHMC Meeting

August 20, 2008

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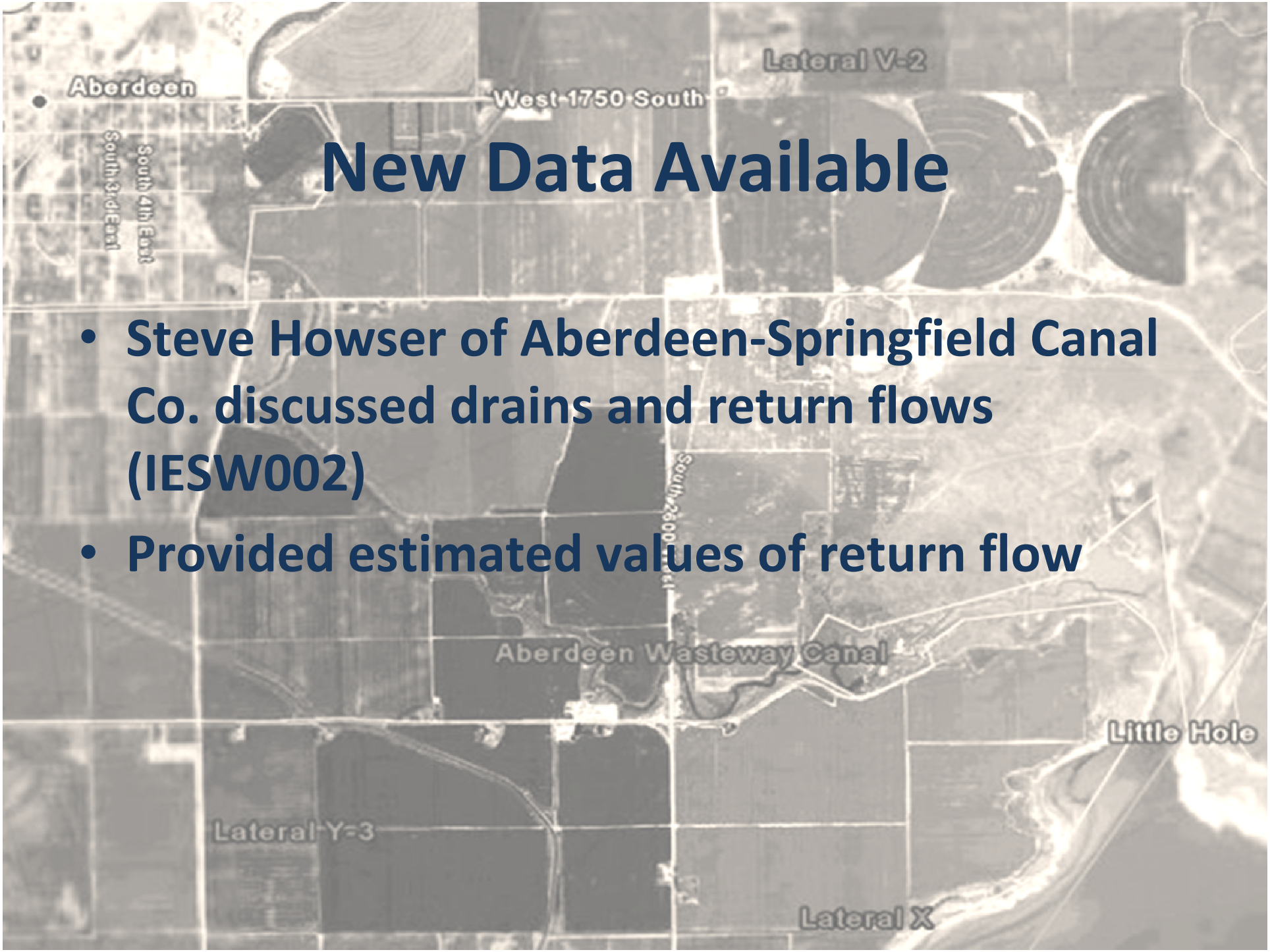
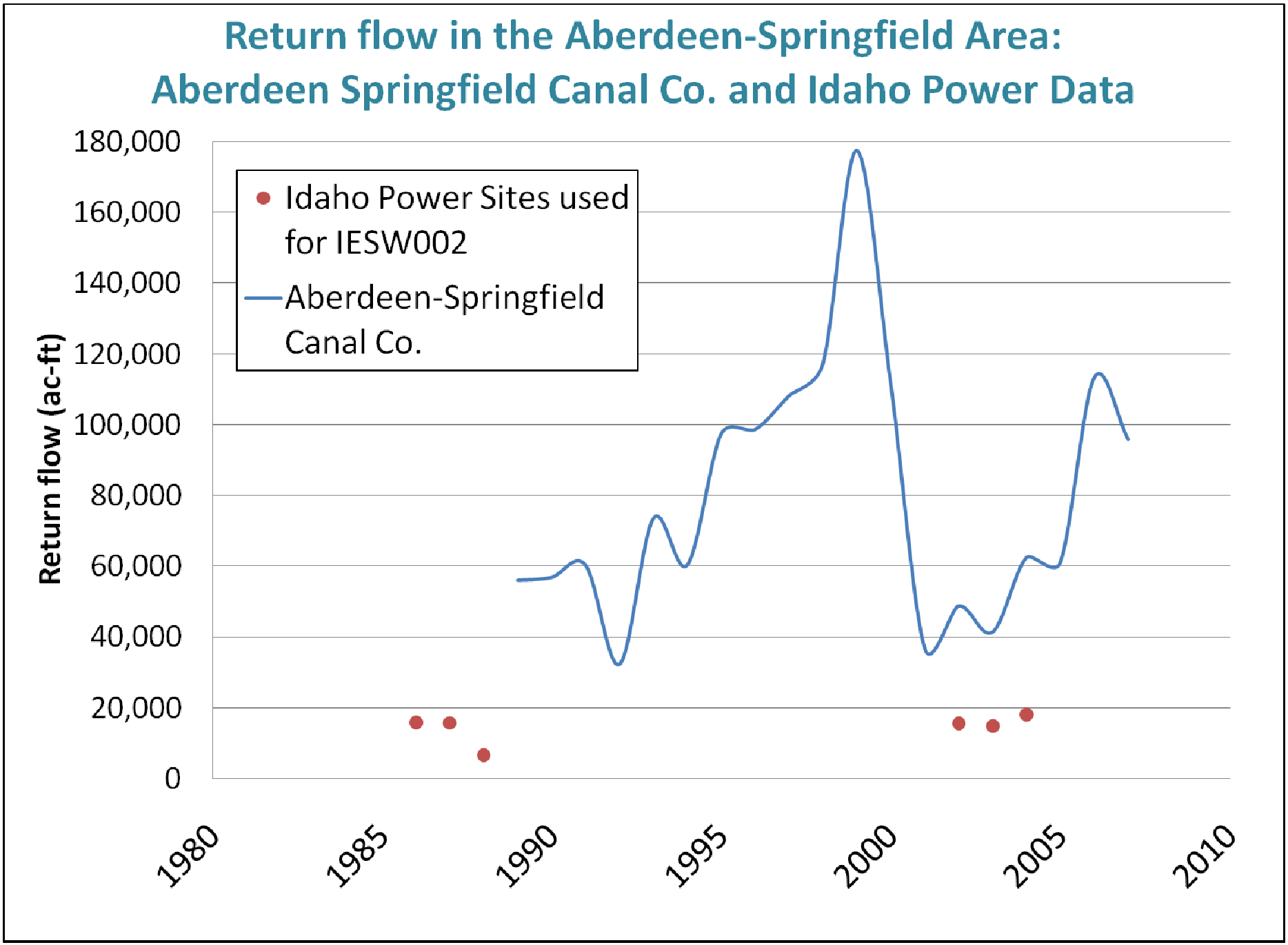
Summary of the last two meetings…

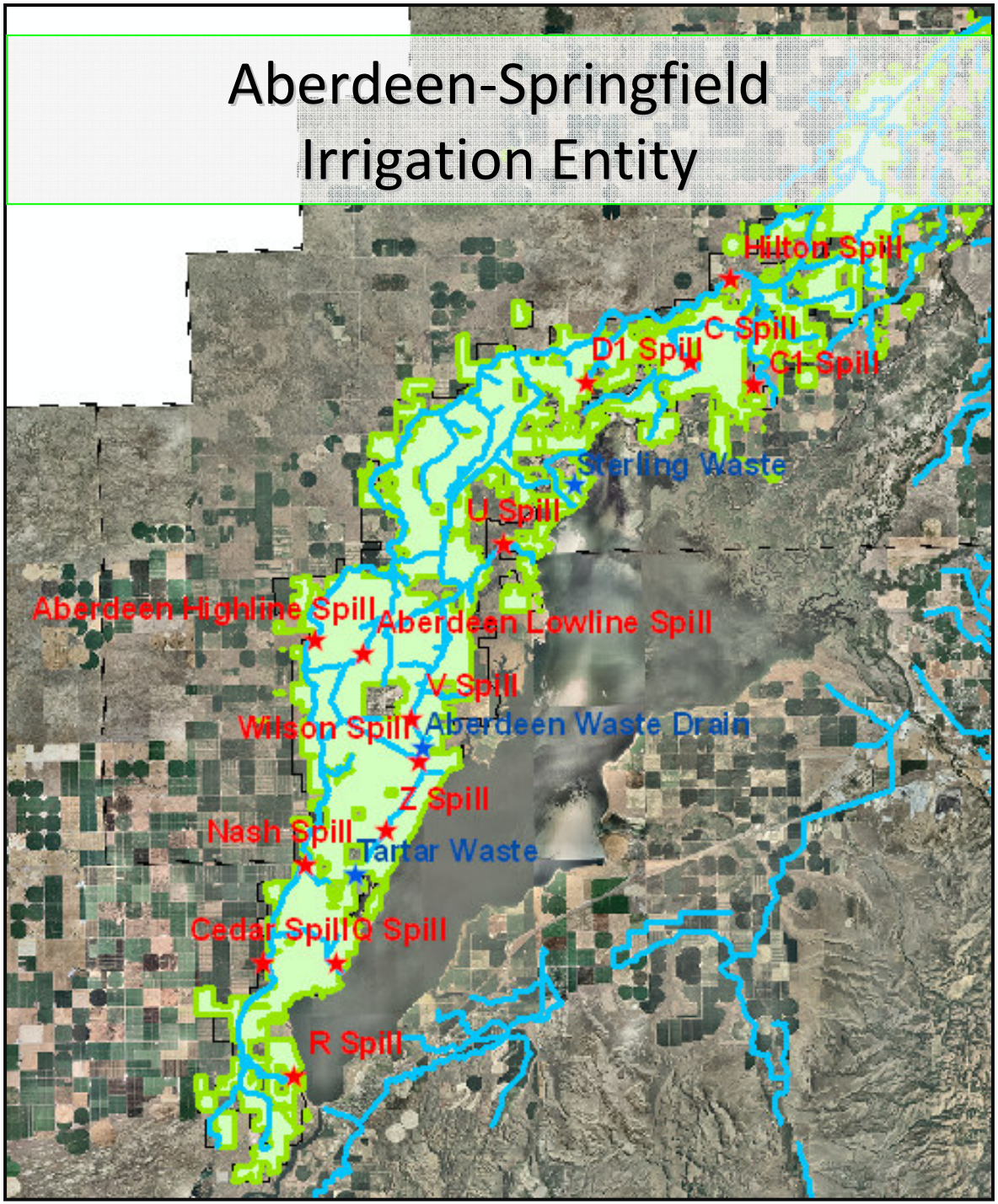
- Prior to last meeting, only annual return flows were examined
- Defining equation (linear vs. quadratic) was not established
- More recommendations to check:
  - Monthly values
  - Sprinkler percentages year to year
  - Presence of hydropower facilities
  - Presence of ponds/wetlands
  - Precipitation
  - Drought index (PDSI)



New Data Available

- Steve Howser of Aberdeen-Springfield Canal Co. discussed drains and return flows (IESW002)
- Provided estimated values of return flow

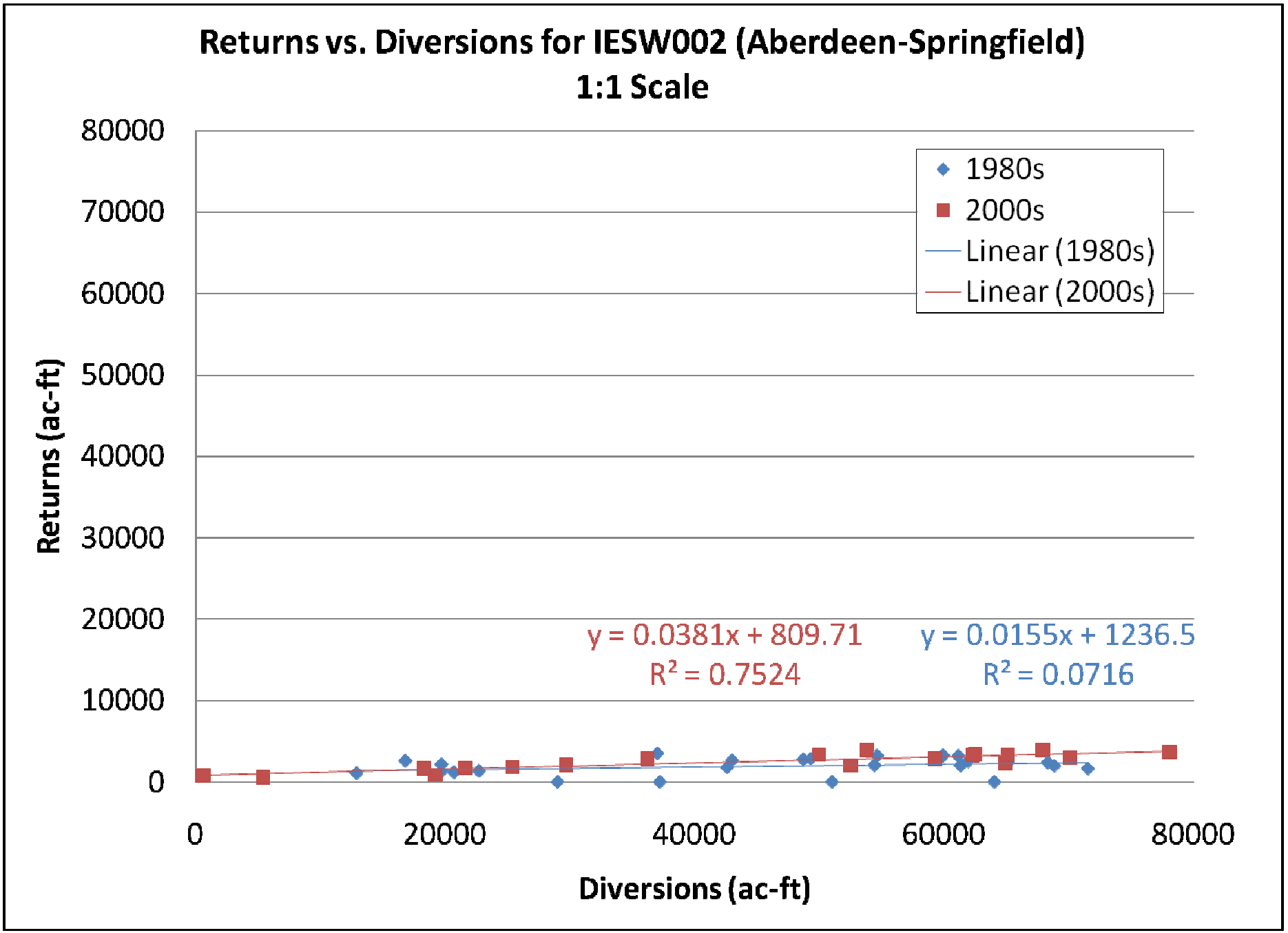

Return flow in the Aberdeen-Springfield Area:
Aberdeen Springfield Canal Co. and Idaho Power Data
Return flow (ac-ft)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1980
1985
1990
1995
2000
2005
2010
Idaho Power Sites used for IESW002
Aberdeen-Springfield Canal Co.

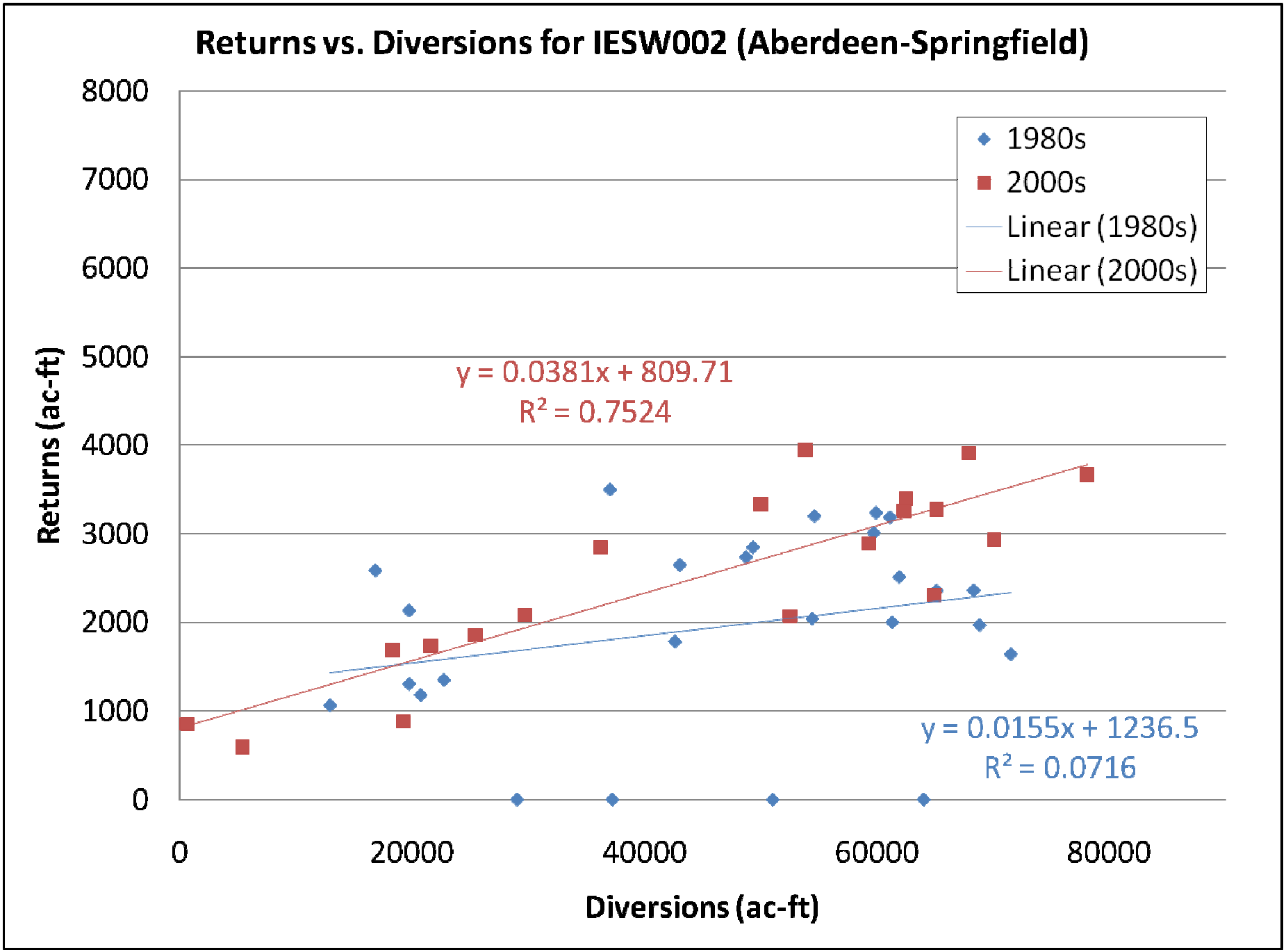

Aberdeen-Springfield
Irrigation Entity
Hilton Spill
C Spill
D1 Spill
G1 Spill
Sterling Waste
U Spill
Aberdeen Highline Spill
Aberdeen Lowline Spill
V Spill
Wilson Spill
Aberdeen Waste Drain
Z Spill
Nash Spill
Tartar Waste
Cedar Spill
Q Spill
R Spill

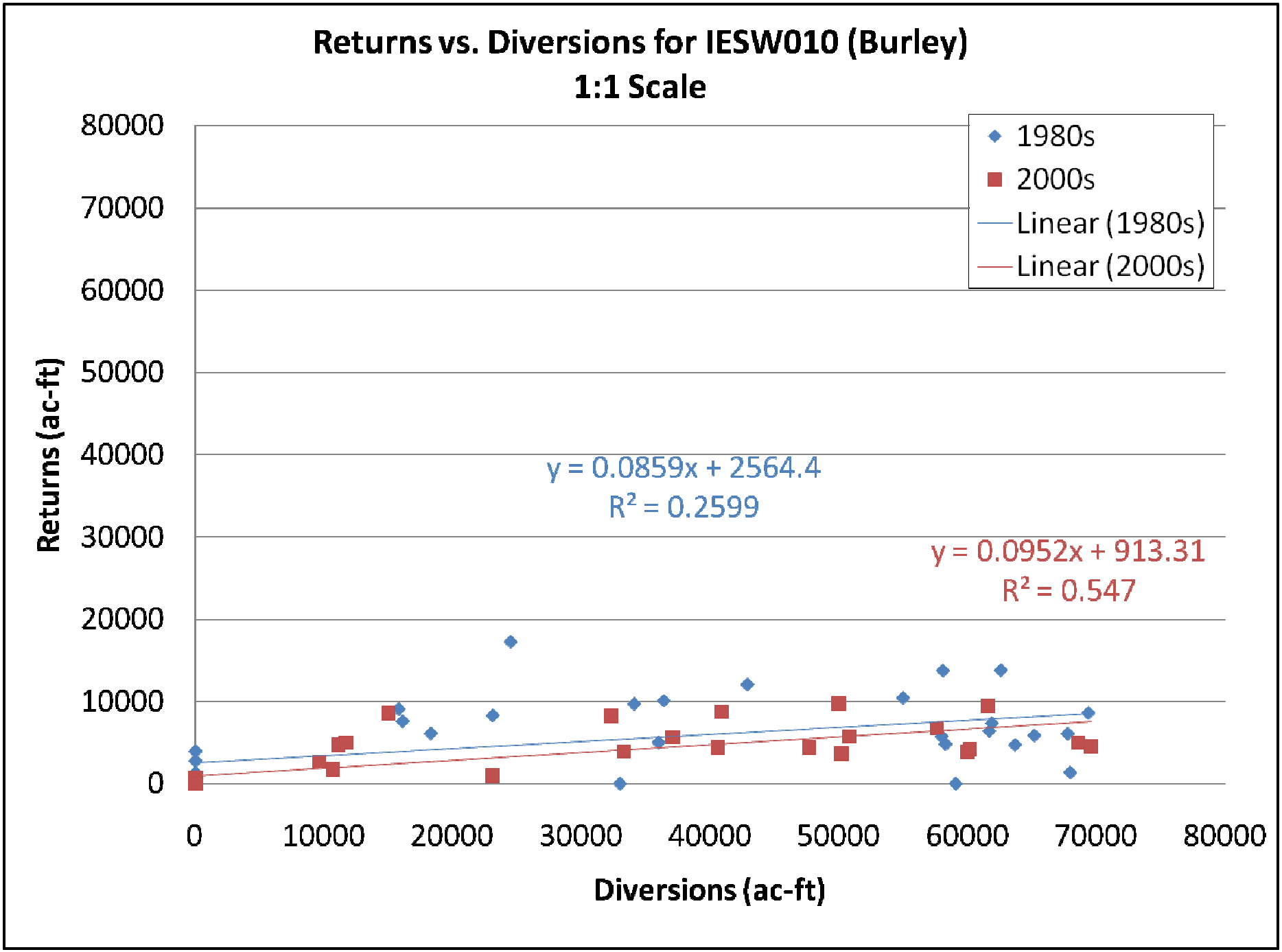
Points to Ponder

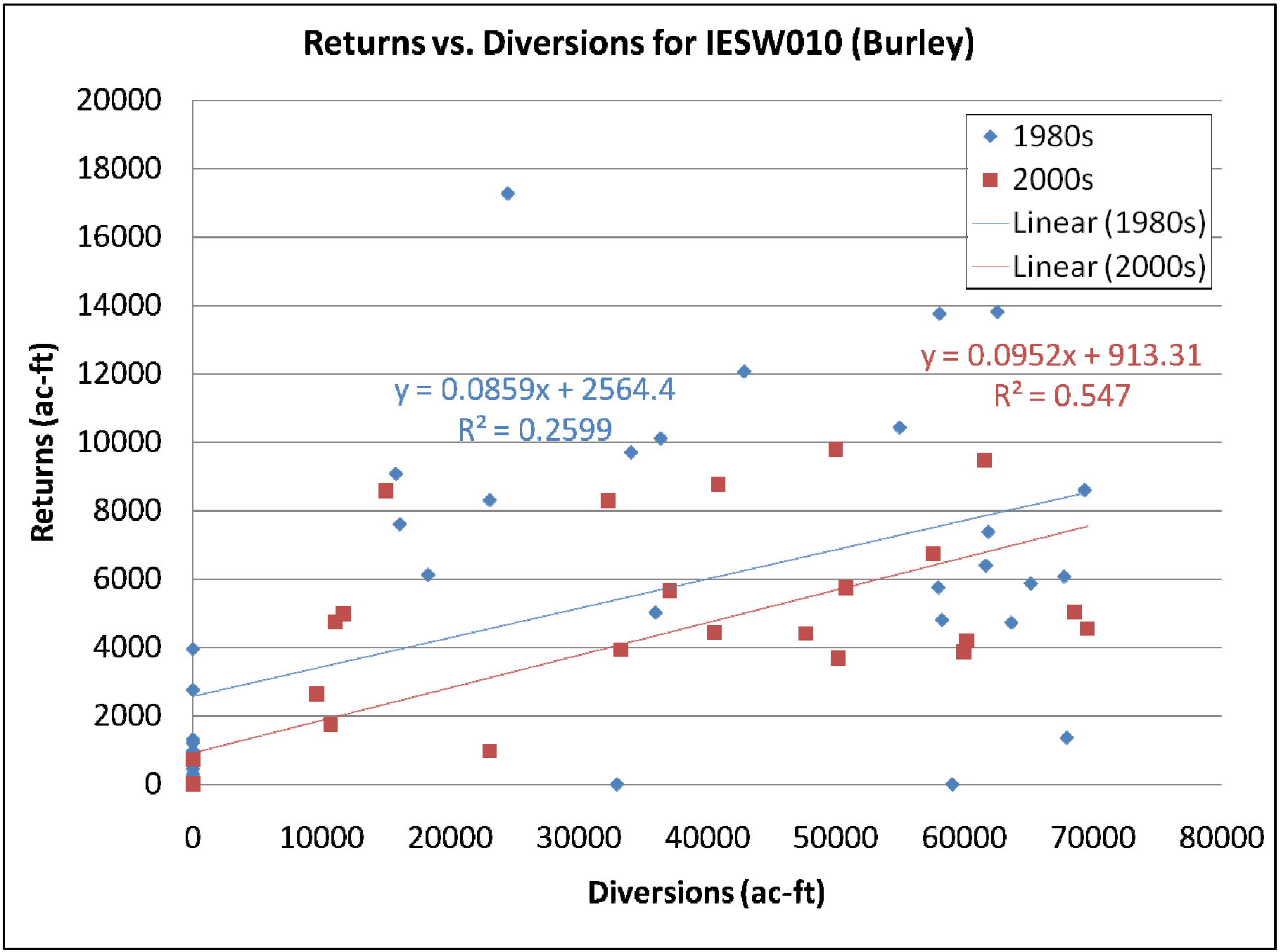
- Current ASCC data is missing data between 1988 and 2002
- Gage sites where return flows are measured do not appear to be what directly returns to the river
- Question: Do we want to use the data?

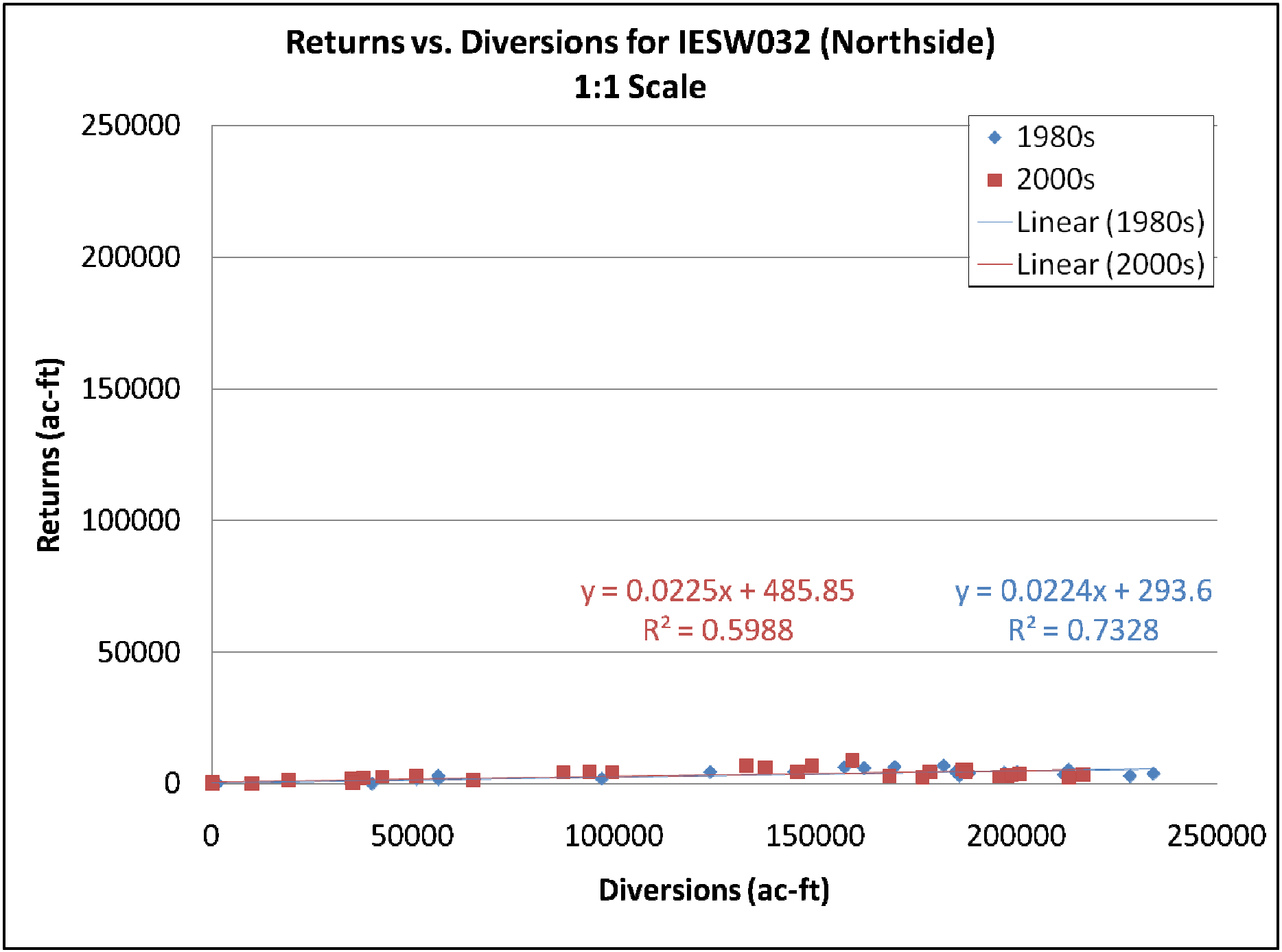
MONTHLY ANALYSIS

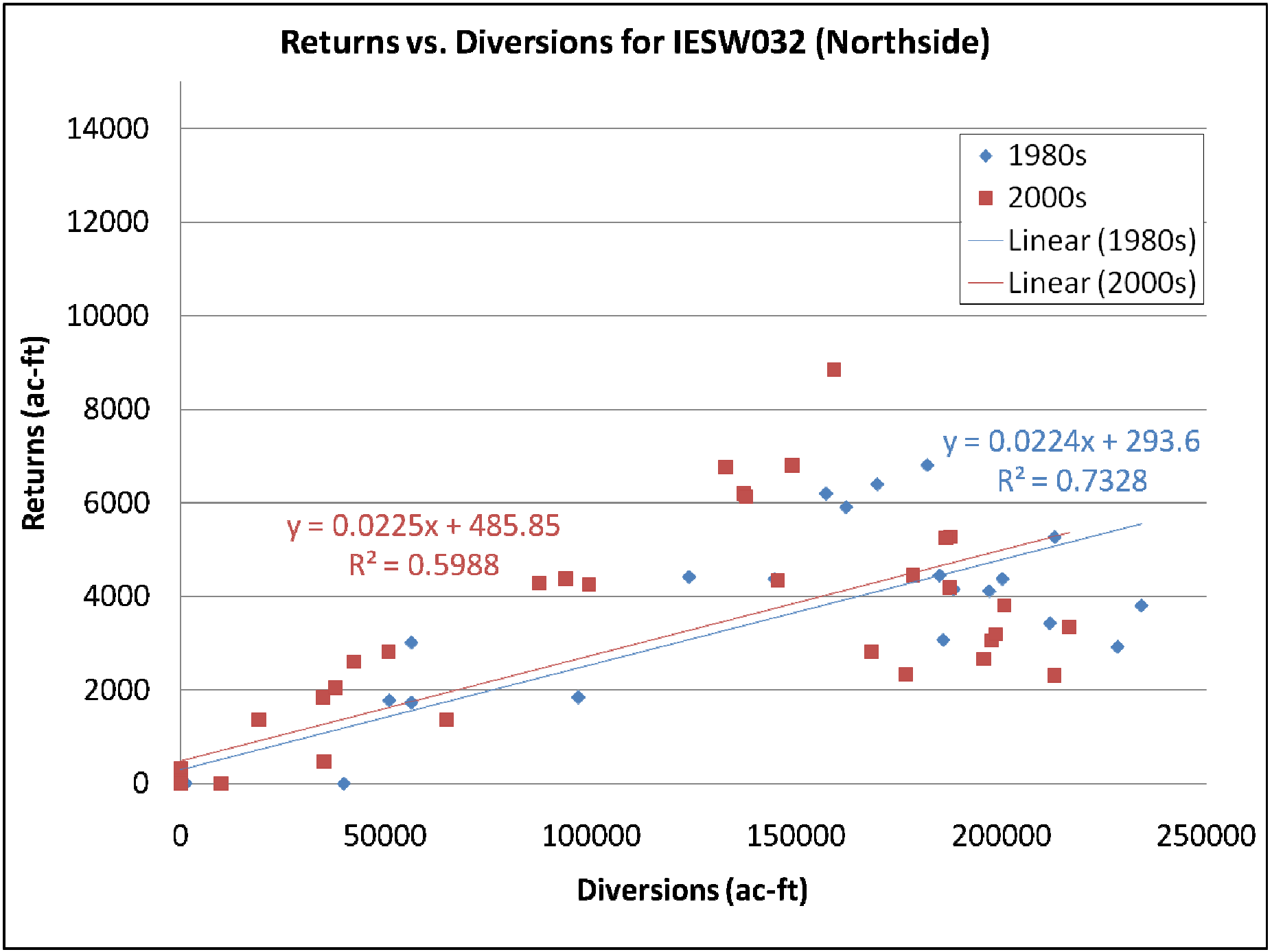

Returns vs. Diversions for IESW002 (Aberdeen-Springfield)
1:1 Scale
Returns (ac-ft)
80000
70000
60000
50000
40000
30000
20000
10000
0
0
20000
40000
60000
80000
Diversions (ac-ft)
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0381x + 809.71
R² = 0.7524
y = 0.0155x + 1236.5
R² = 0.0716

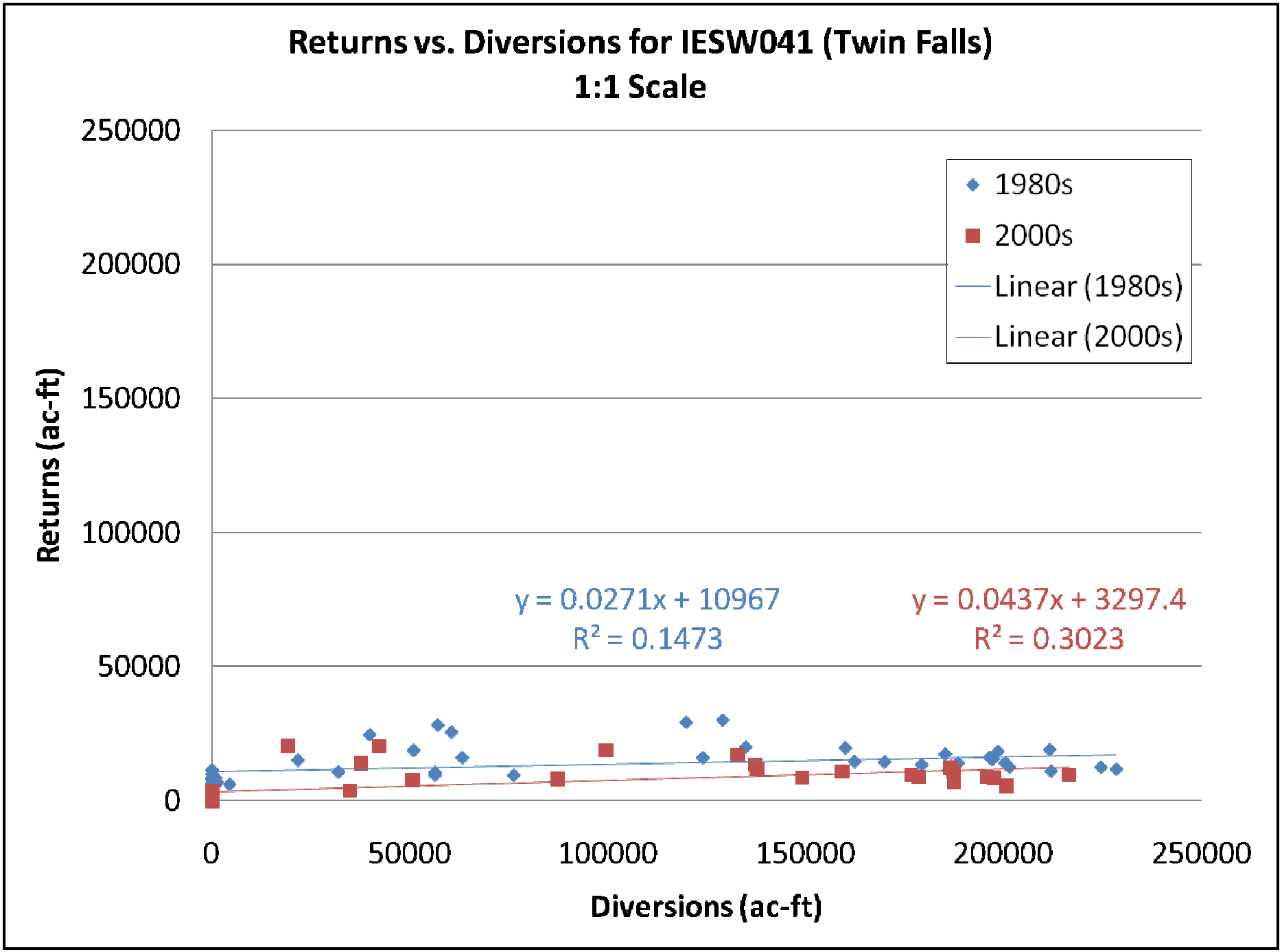

Returns vs. Diversions for IESW002 (Aberdeen-Springfield)
8000
7000
6000
5000
4000
3000
2000
1000
0
Returns (ac-ft)
0
20000
40000
60000
80000
Diversions (ac-ft)
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0381x + 809.71
R² = 0.7524
y = 0.0155x + 1236.5
R² = 0.0716

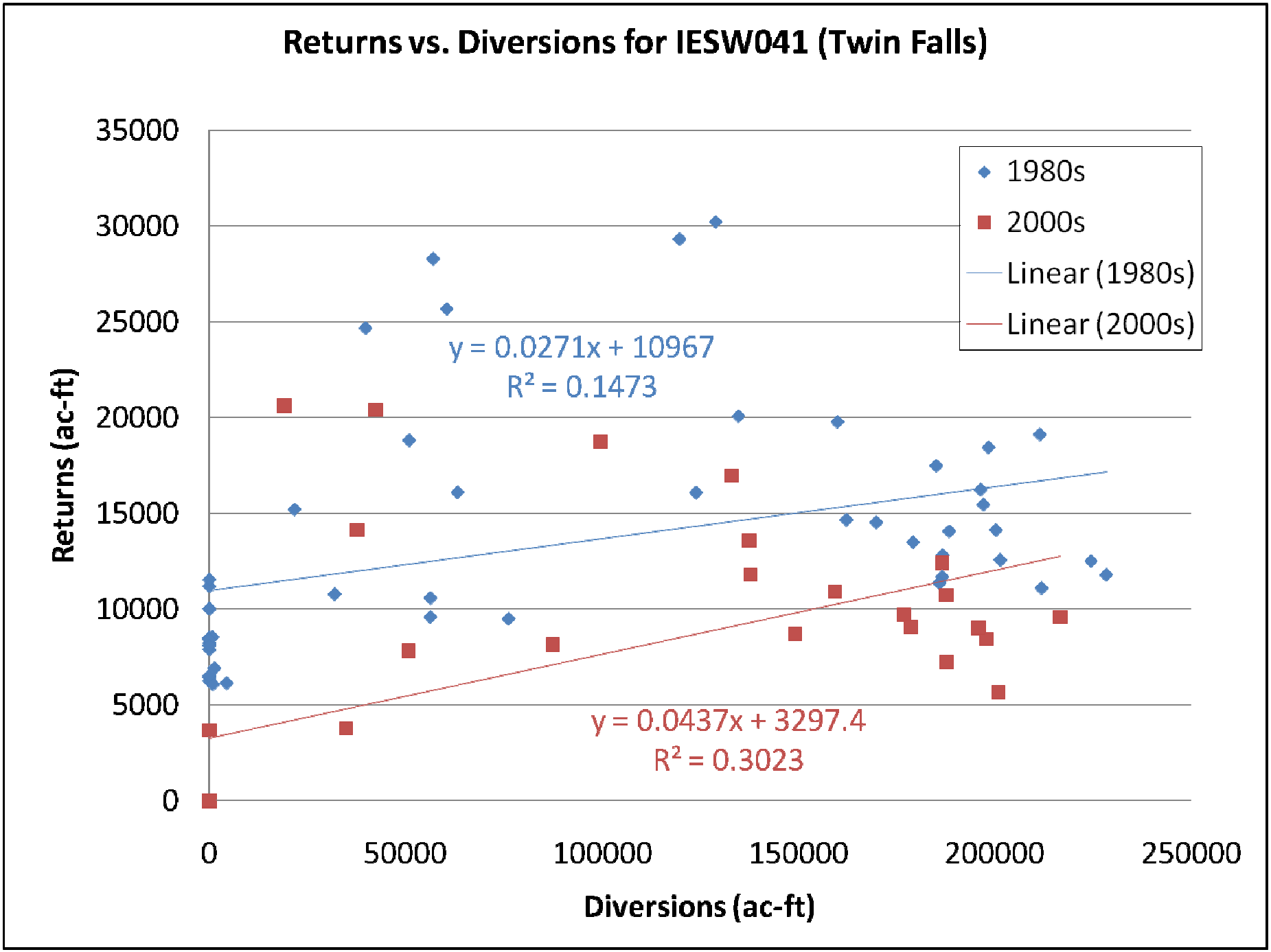

Returns vs. Diversions for IESW010 (Burley)
1:1 Scale
Returns (ac-ft)
Diversions (ac-ft)
80000
70000
60000
50000
40000
30000
20000
10000
0
0
10000
20000
30000
40000
50000
60000
70000
80000
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0859x + 2564.4
R² = 0.2599
y = 0.0952x + 913.31
R² = 0.547

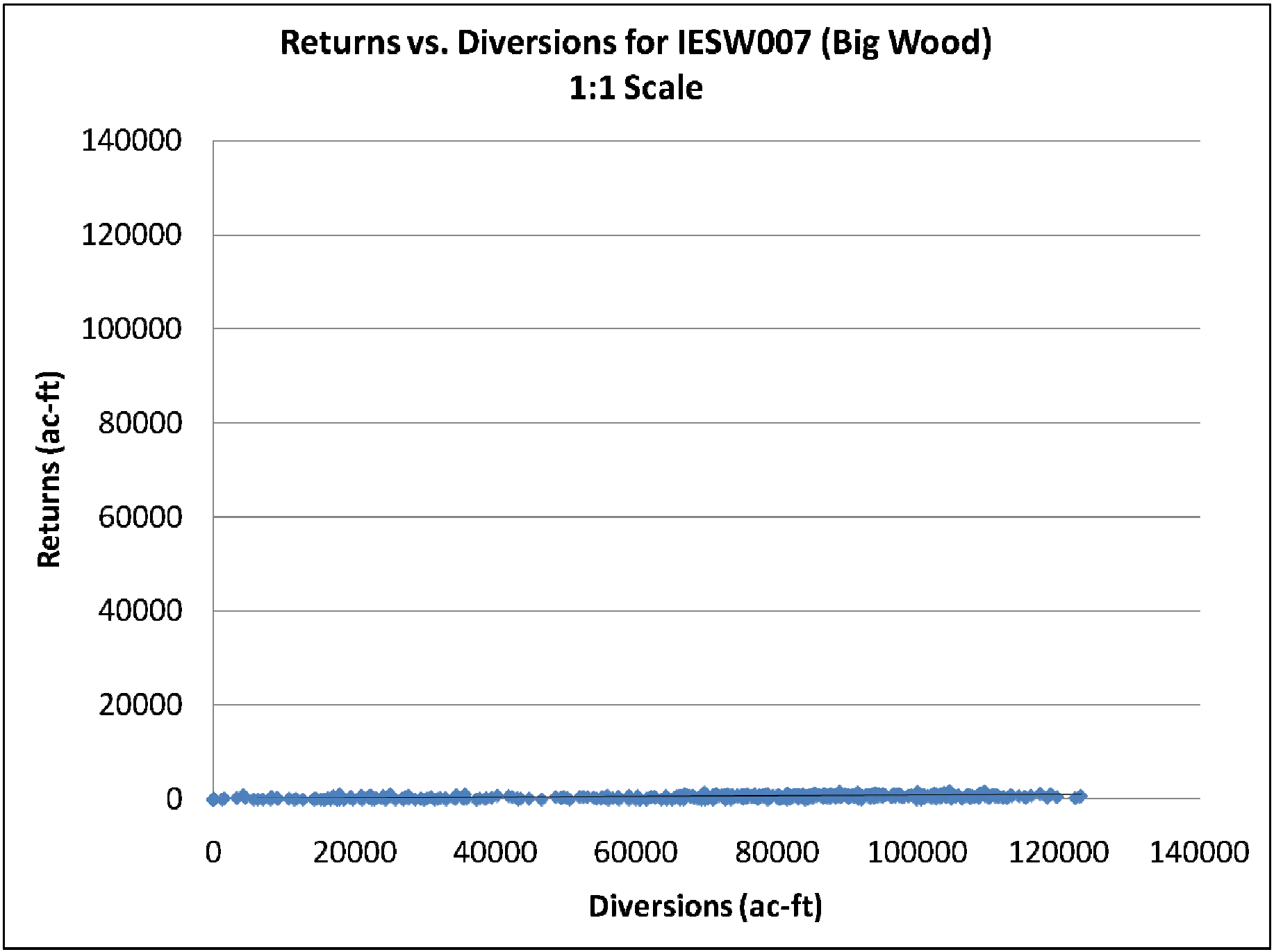

Returns vs. Diversions for IESW010 (Burley)
Returns (ac-ft)
Diversions (ac-ft)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
10000
20000
30000
40000
50000
60000
70000
80000
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0859x + 2564.4
R² = 0.2599
y = 0.0952x + 913.31
R² = 0.547

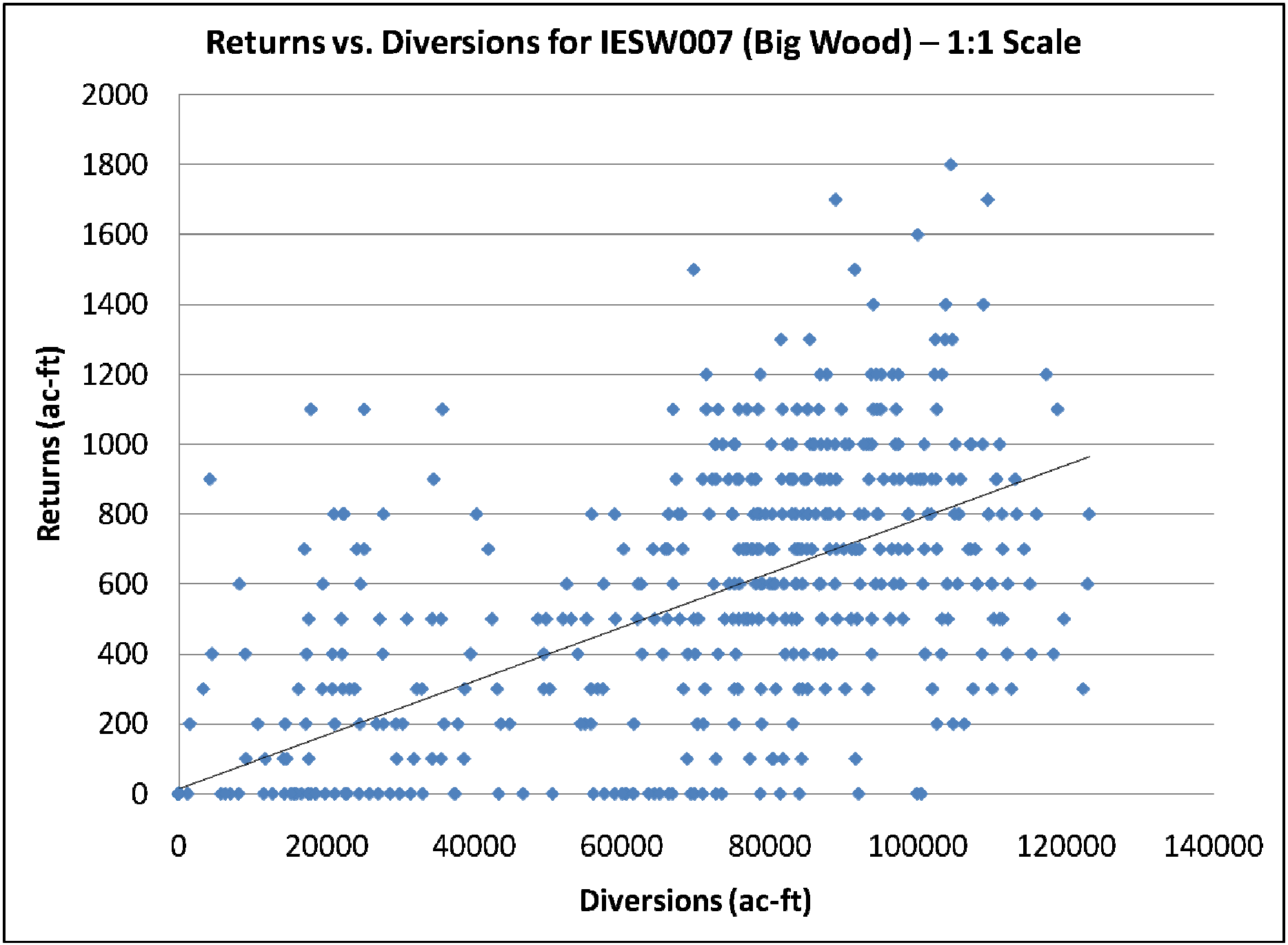

Returns vs. Diversions for IESW032 (Northside)
1:1 Scale
250000
200000
150000
100000
50000
0
Returns (ac-ft)
0
50000
100000
150000
200000
250000
Diversions (ac-ft)
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0225x + 485.85
R² = 0.5988
y = 0.0224x + 293.6
R² = 0.7328

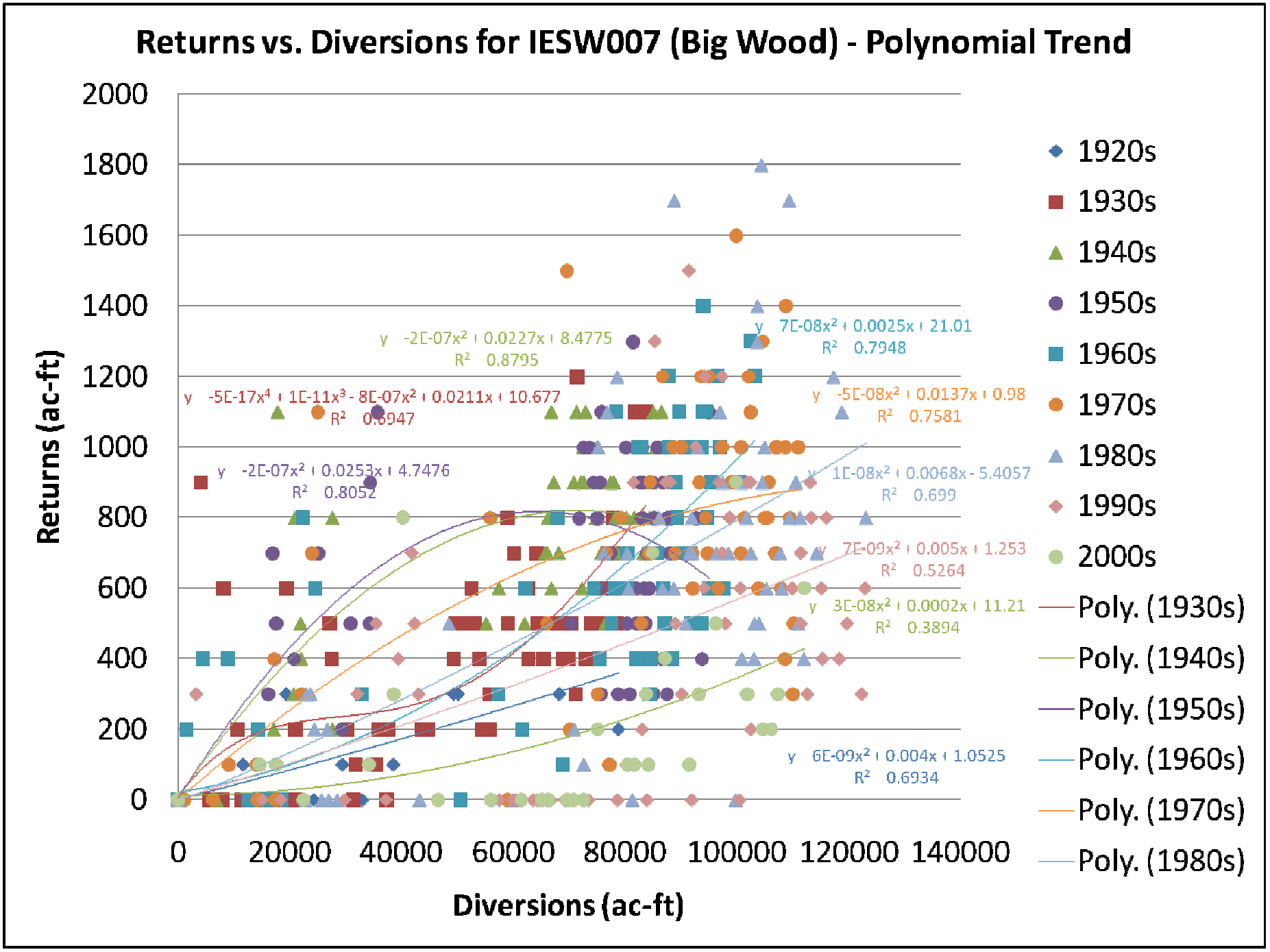

Returns vs. Diversions for IESW032 (Northside)
Returns (ac-ft)
14000
12000
10000
8000
6000
4000
2000
0
0
50000
100000
150000
200000
250000
Diversions (ac-ft)
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0224x + 293.6
R² = 0.7328
y = 0.0225x + 485.85
R² = 0.5988

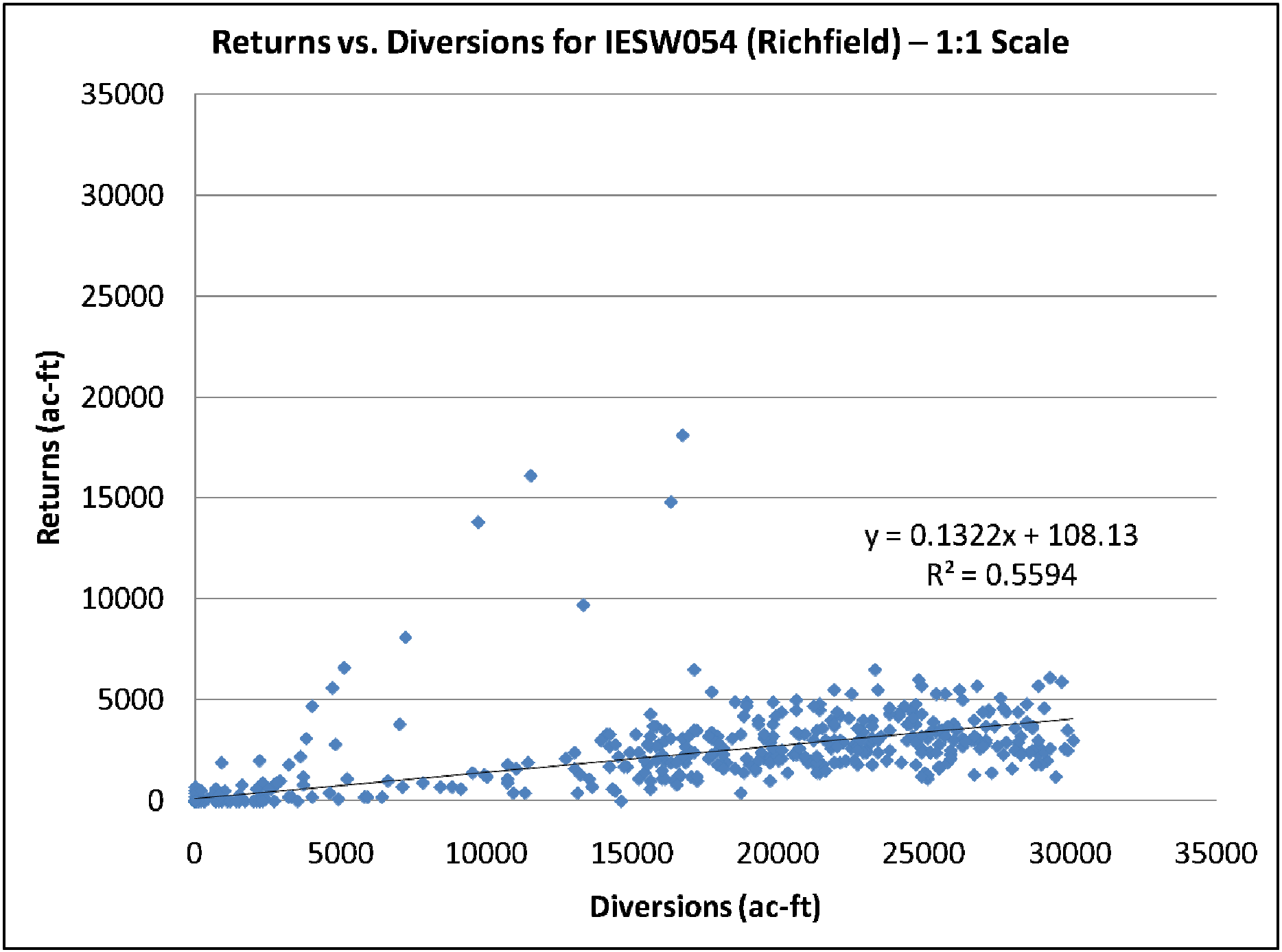

Returns vs. Diversions for IESW041 (Twin Falls)
1:1 Scale
250000
200000
150000
100000
50000
0
Returns (ac-ft)
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0271x + 10967
R² = 0.1473
y = 0.0437x + 3297.4
R² = 0.3023
0
50000
100000
150000
200000
250000
Diversions (ac-ft)

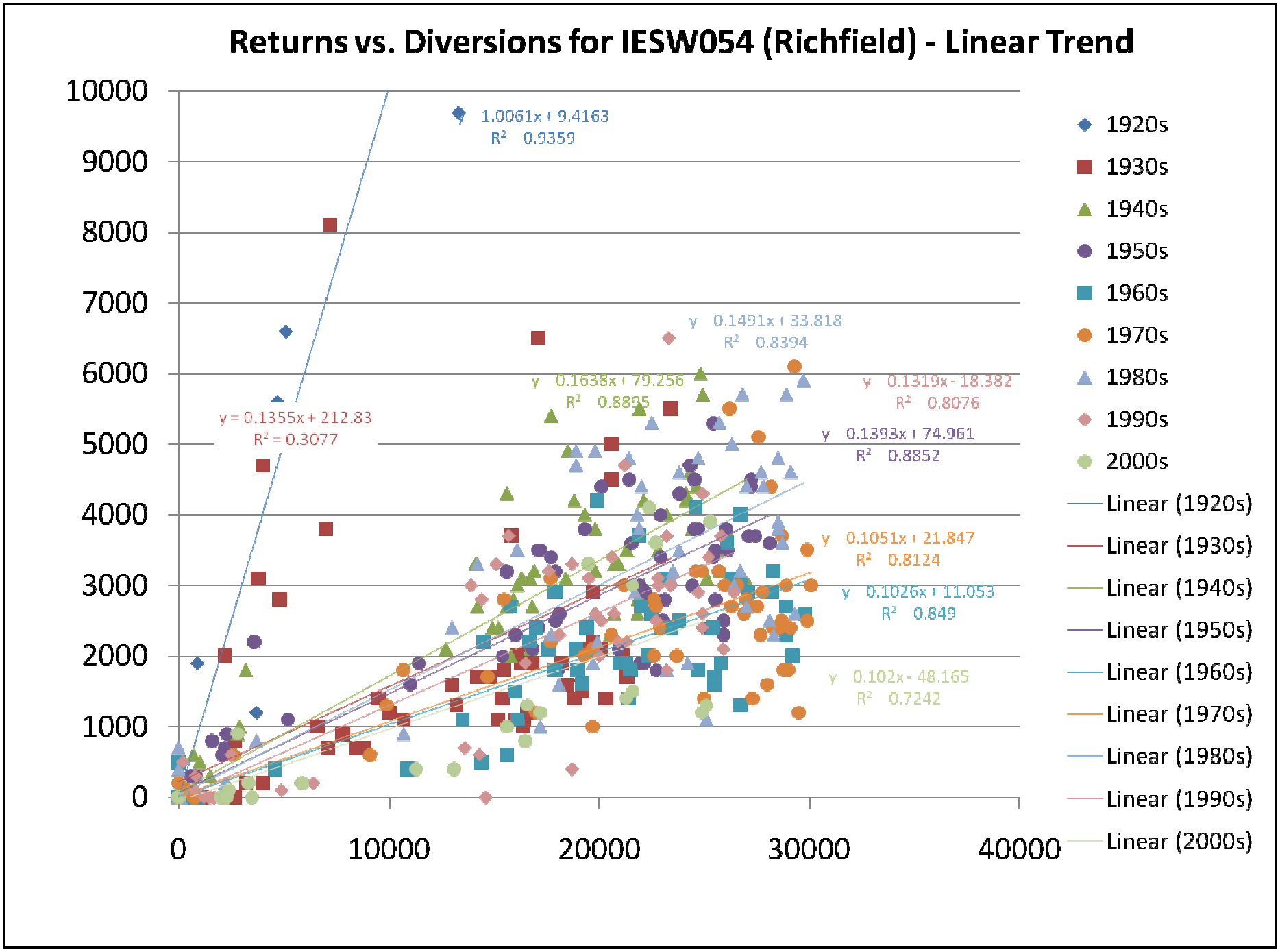

Returns vs. Diversions for IESW041 (Twin Falls)
Returns (ac-ft)
35000
30000
25000
20000
15000
10000
5000
0
0
50000
100000
150000
200000
250000
Diversions (ac-ft)
1980s
2000s
Linear (1980s)
Linear (2000s)
y = 0.0271x + 10967
R² = 0.1473
y = 0.0437x + 3297.4
R² = 0.3023


Returns vs. Diversions for IESW007 (Big Wood)
1:1 Scale
140000
120000
100000
80000
60000
40000
20000
0
Returns (ac-ft)
0
20000
40000
60000
80000
100000
120000
140000
Diversions (ac-ft)

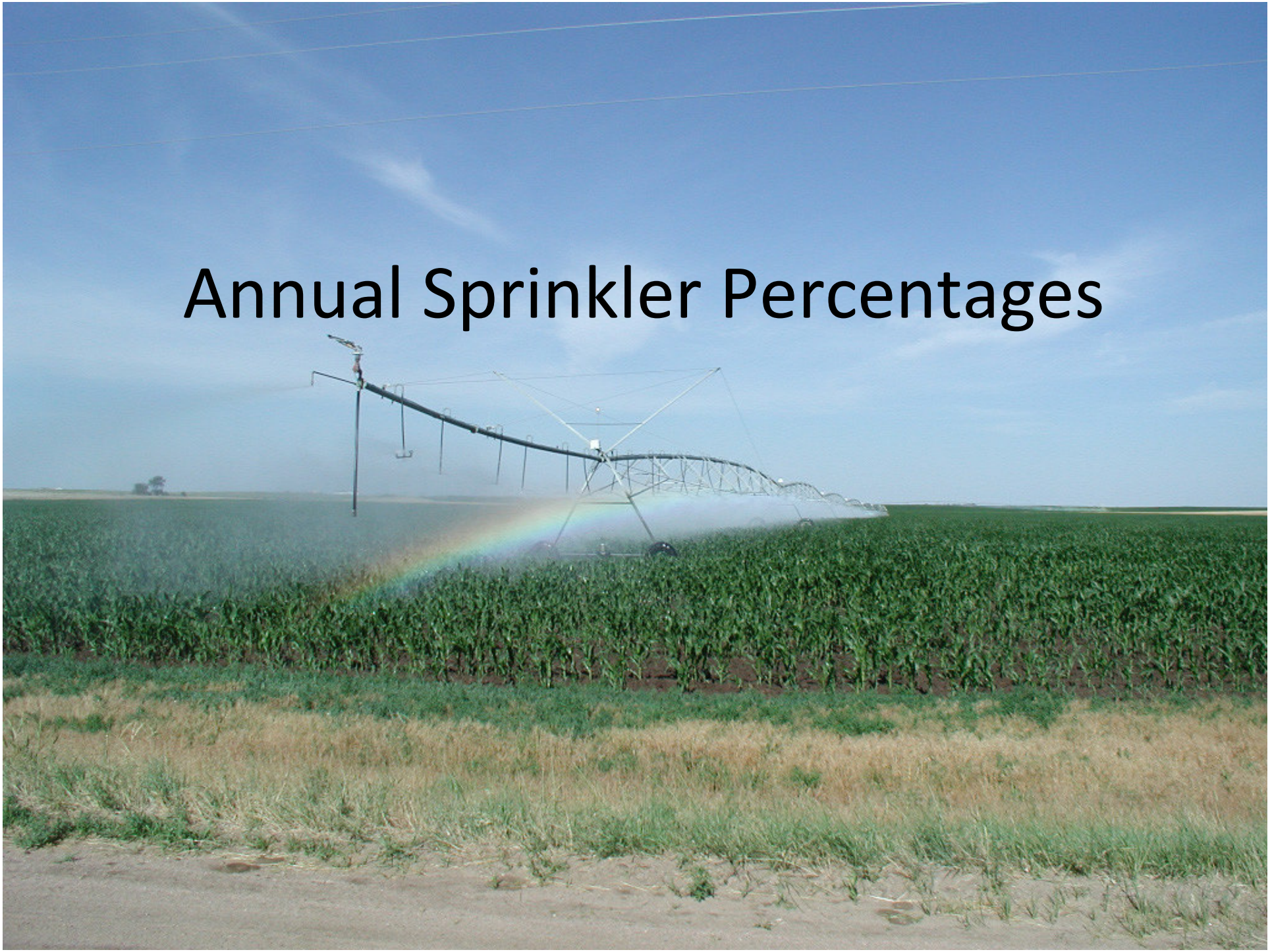

Returns vs. Diversions for IESW007 (Big Wood) – 1:1 Scale
Returns (ac-ft)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
20000
40000
60000
80000
100000
120000
140000
Diversions (ac-ft)

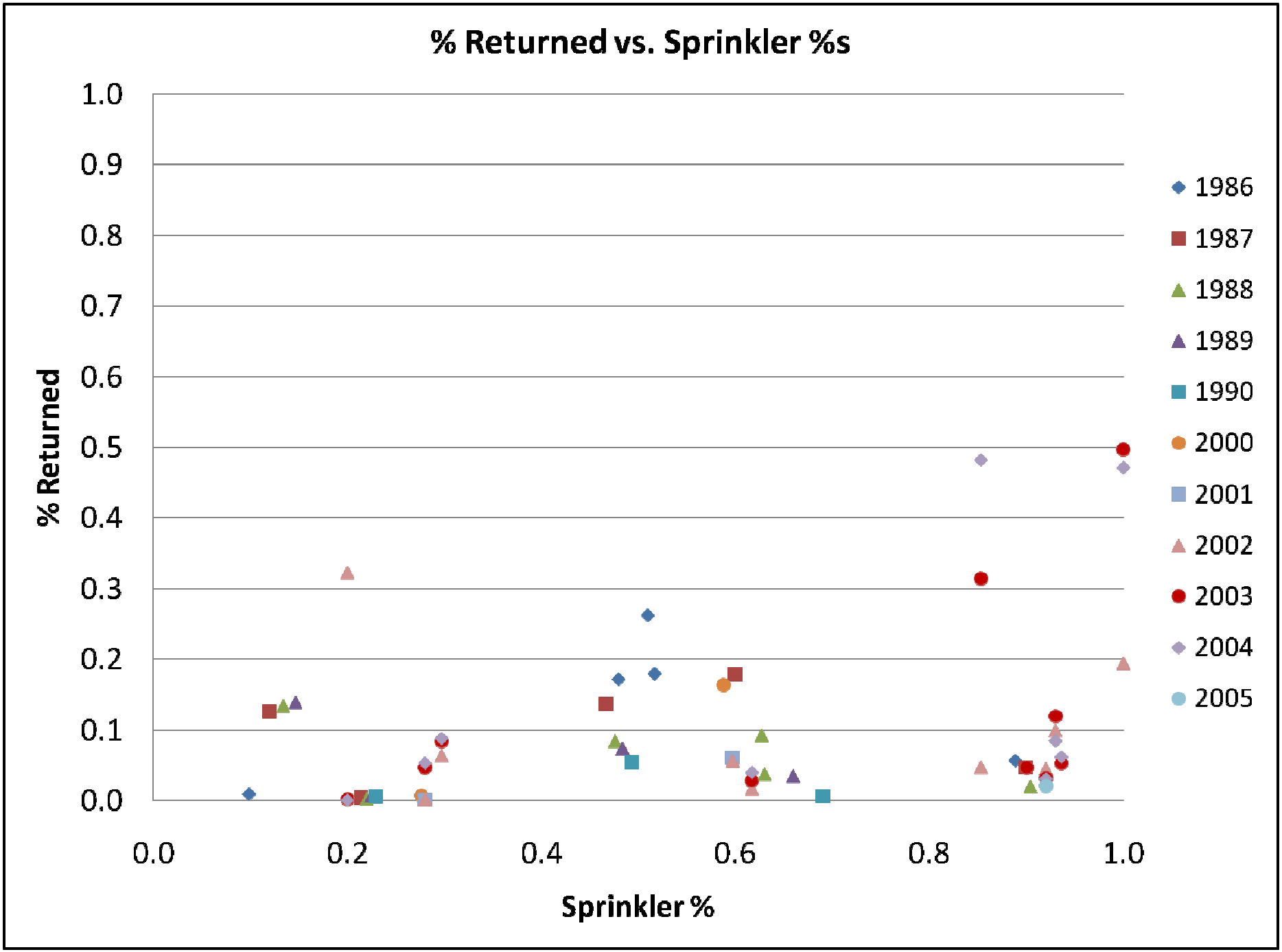

Returns vs. Diversions for IESW007 (Big Wood) - Polynomial Trend
Returns (ac-ft)
Diversions (ac-ft)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0
20000
40000
60000
80000
100000
120000
140000
y = -2E-07x² + 0.0227x + 8.4775
R² = 0.8795
y = 7E-08x² + 0.0025x + 21.01
R² = 0.7948
y = -5E-17x⁴ + 1E-11x³ - 8E-07x² + 0.0211x + 10.677
R² = 0.6947
y = -5E-08x² + 0.0137x + 0.98
R² = 0.7581
y = -2E-07x² + 0.0253x + 4.7476
R² = 0.8052
y = 1E-08x² + 0.0068x - 5.4057
R² = 0.699
y = 7E-09x² + 0.005x + 1.253
R² = 0.5264
y = 3E-08x² + 0.0002x + 11.21
R² = 0.3894
y = 6E-09x² + 0.004x + 1.0525
R² = 0.6934
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000s
Poly. (1930s)
Poly. (1940s)
Poly. (1950s)
Poly. (1960s)
Poly. (1970s)
Poly. (1980s)


Returns vs. Diversions for IESW054 (Richfield) – 1:1 Scale
Returns (ac-ft)
35000
30000
25000
20000
15000
10000
5000
0
y = 0.1322x + 108.13
R² = 0.5594
0
5000
10000
15000
20000
25000
30000
35000
Diversions (ac-ft)


Returns vs. Diversions for IESW054 (Richfield) - Linear Trend
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10000
20000
30000
40000
y = 1.0061x + 9.4163
R² = 0.9359
y = 0.1491x + 33.818
R² = 0.8394
y = 0.1638x + 79.256
R² = 0.8895
y = 0.1355x + 212.83
R² = 0.3077
y = 0.1319x - 18.382
R² = 0.8076
y = 0.1393x + 74.961
R² = 0.8852
y = 0.1051x + 21.847
R² = 0.8124
y = 0.1026x + 11.053
R² = 0.849
y = 0.102x - 48.165
R² = 0.7242
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000s
Linear (1920s)
Linear (1930s)
Linear (1940s)
Linear (1950s)
Linear (1960s)
Linear (1970s)
Linear (1980s)
Linear (1990s)
Linear (2000s)

Annual Sprinkler Percentages

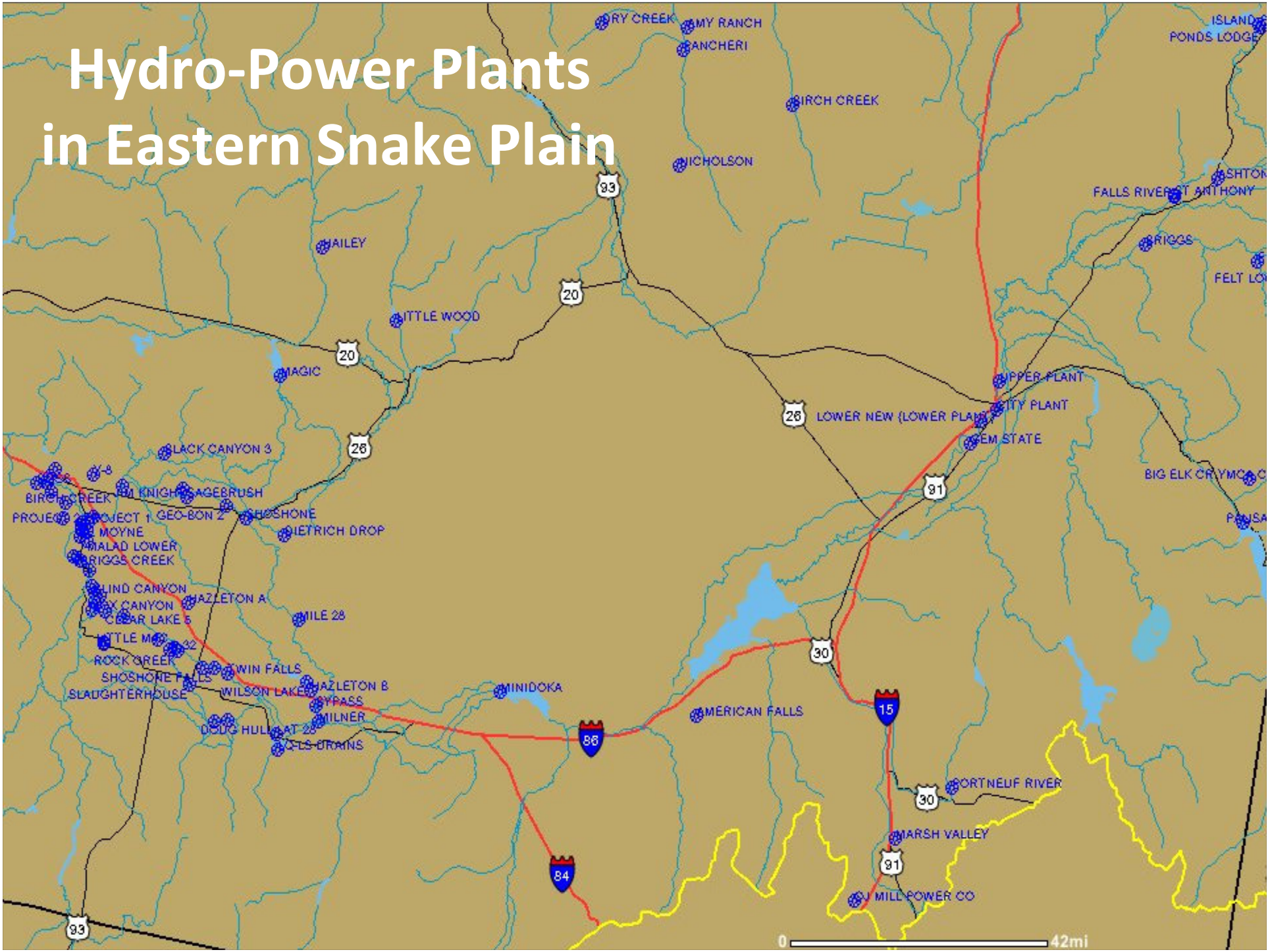



% Returned vs. Sprinkler %s
% Returned
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Sprinkler %
1986
1987
1988
1989
1990
2000
2001
2002
2003
2004
2005

Hydro-Power Facilities

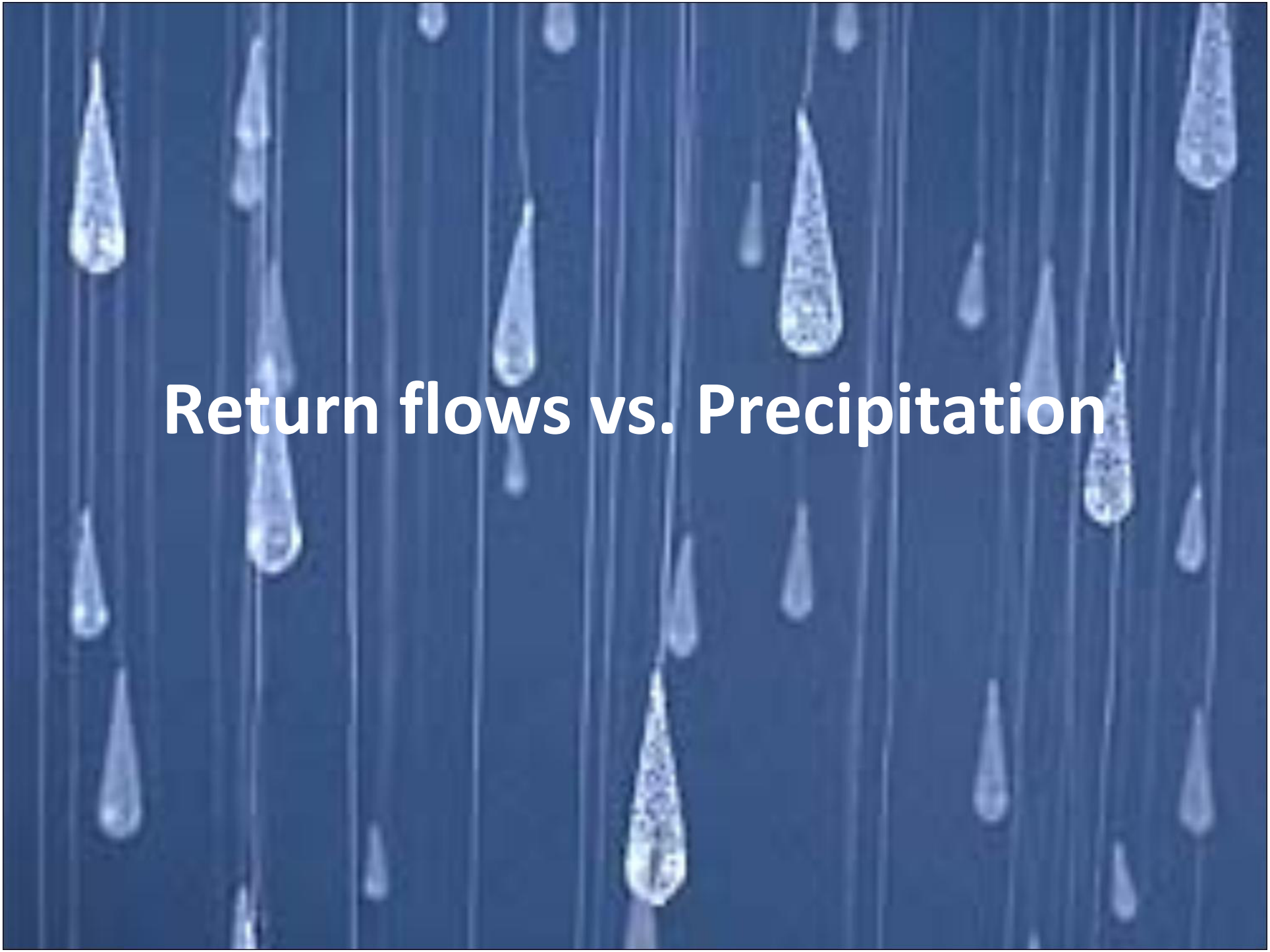
- Several facilities in the Eastern Snake Plain
- Researched WHEN hydro-plants were built and if they were re-built
- Problem:
  - Hydro-plant installed long before data collected (unable to see difference in data)
  - No significant change in data

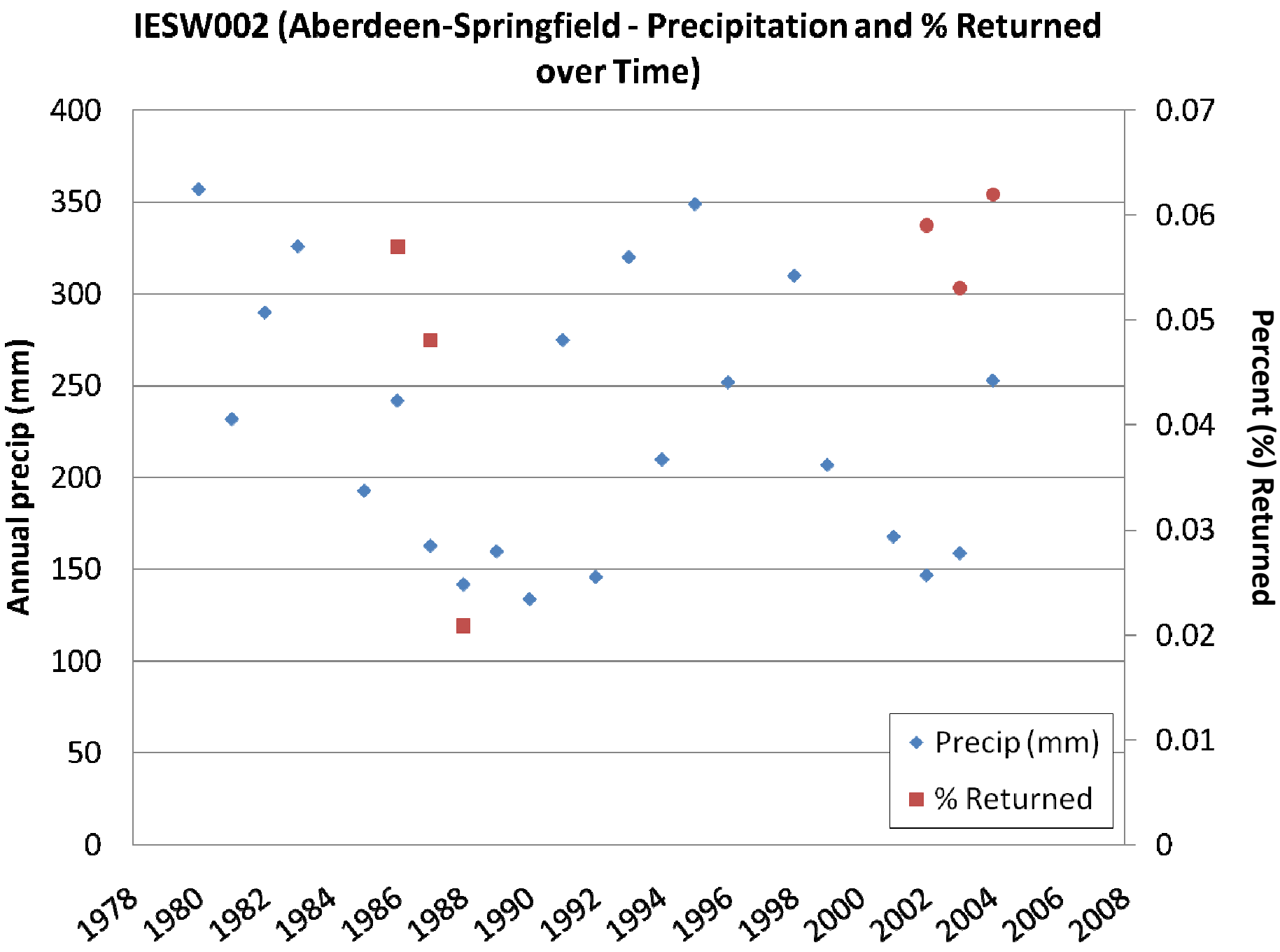
Hydro-Power Plants in Eastern Snake Plain

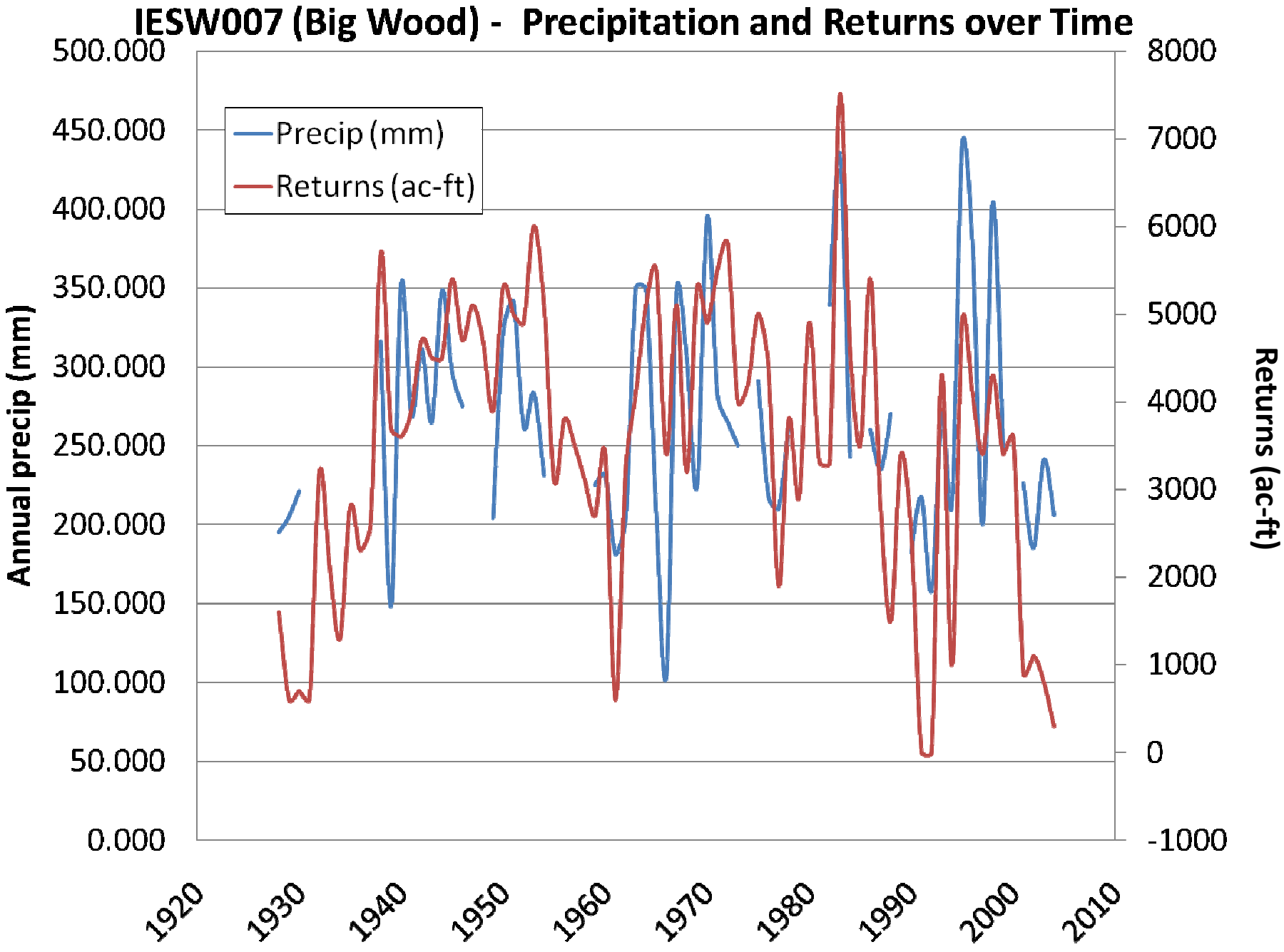


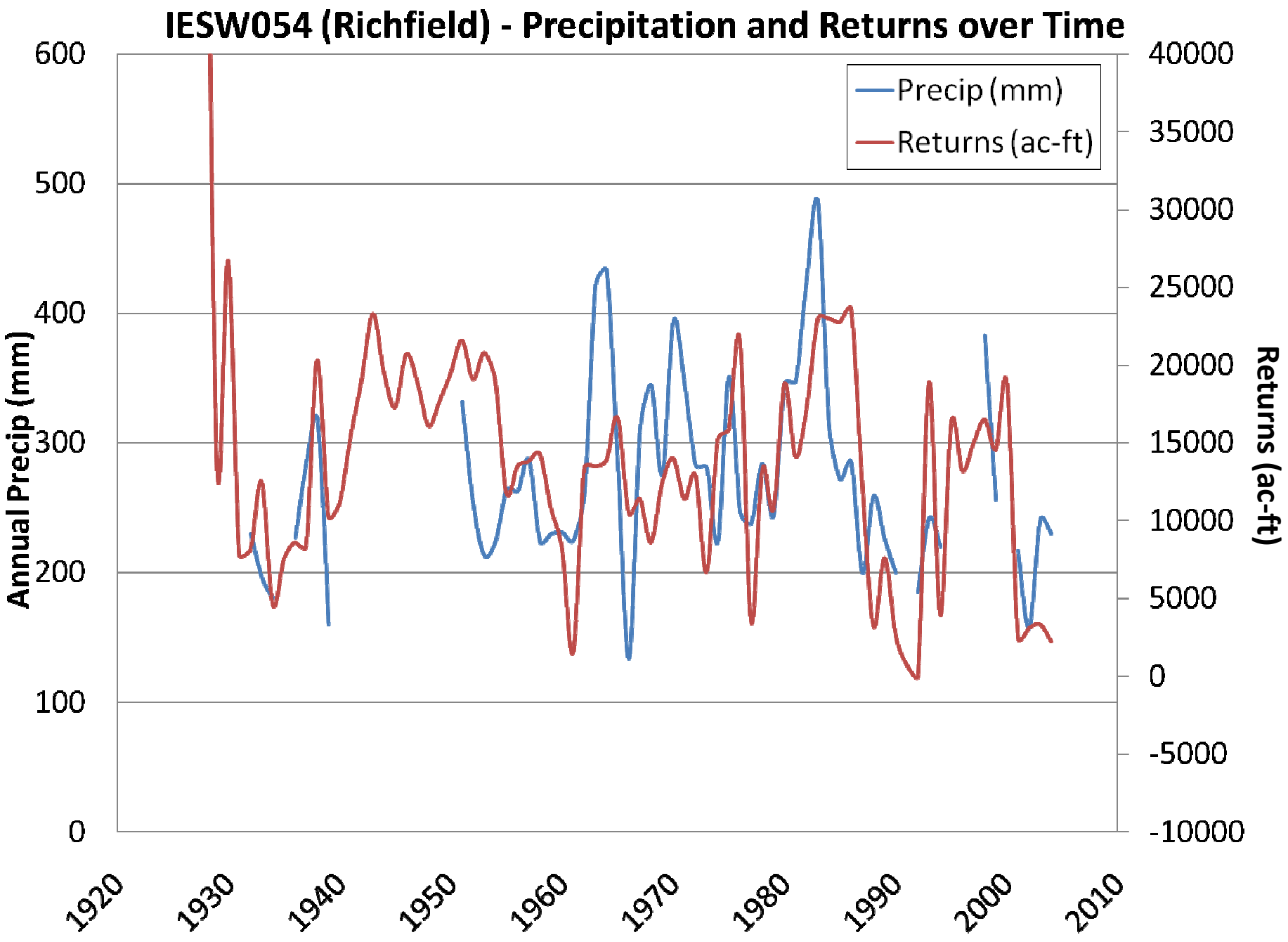
Ponds/Wetlands

- Locations for ponds in several of the surface water irrigation entities were not available
- Data available from the Northside Canal Co. (IESW032) – no visible relationship to the return flow data relative to when ponds were installed

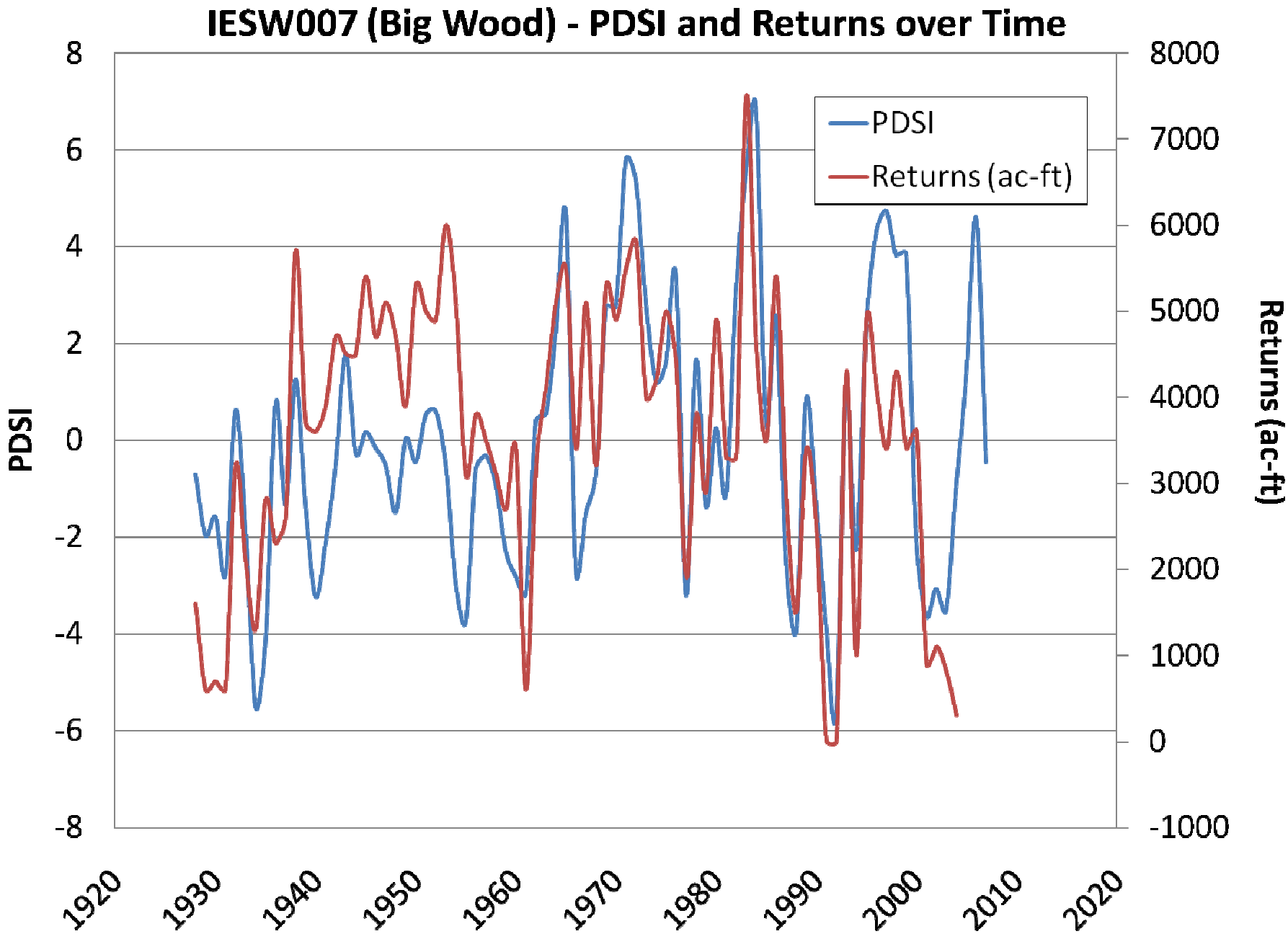

Return flows vs. Precipitation

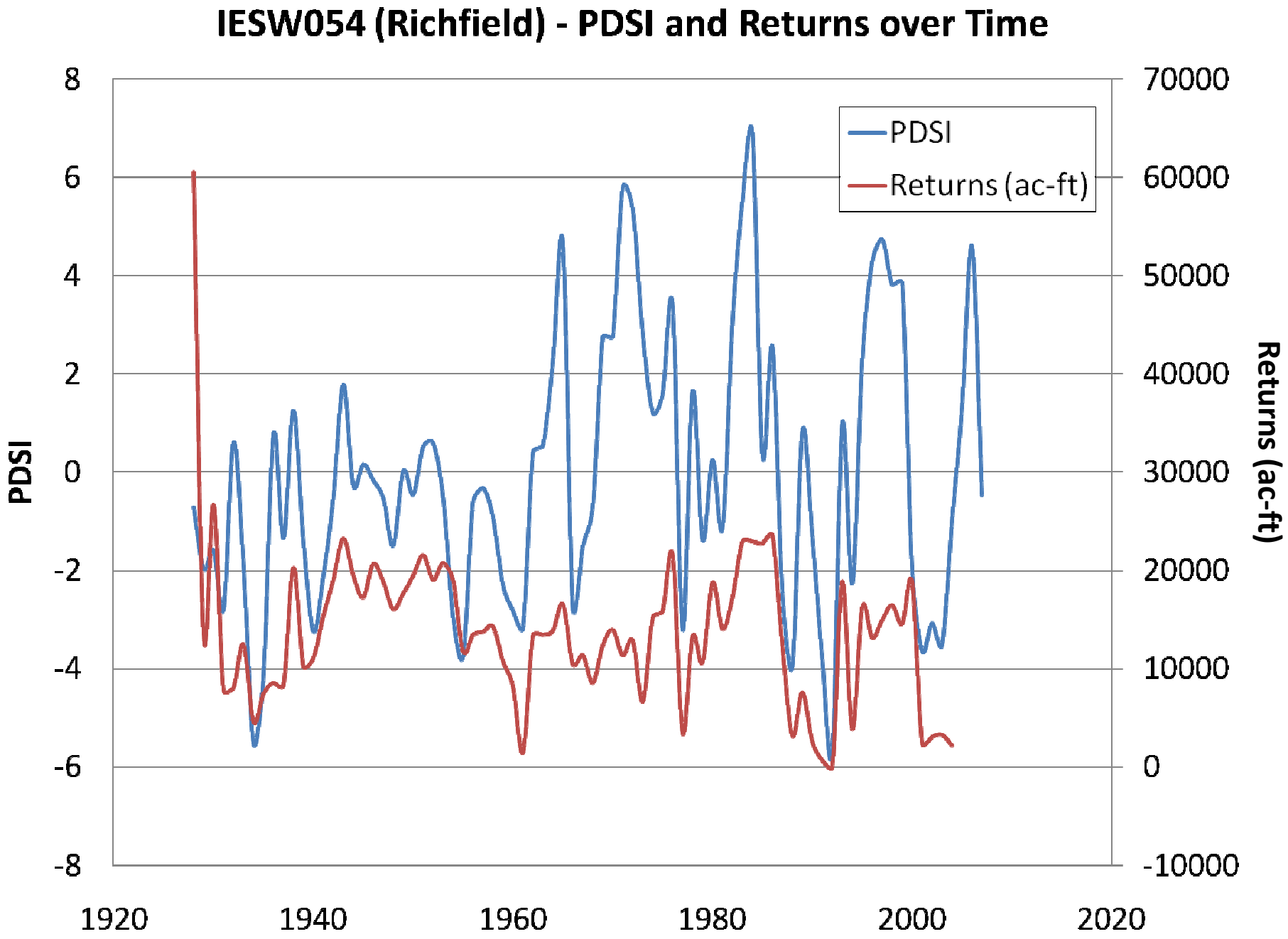

IESW002 (Aberdeen-Springfield - Precipitation and % Returned over Time)
Annual precip (mm)
Percent (%) Returned
400
350
300
250
200
150
100
50
0
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Precip (mm)
% Returned


IESW007 (Big Wood) - Precipitation and Returns over Time
Annual precip (mm)
Returns (ac-ft)
Precip (mm)
Returns (ac-ft)
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
0.000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010


IESW054 (Richfield) - Precipitation and Returns over Time
Precip (mm)
Returns (ac-ft)
Annual Precip (mm)
Returns (ac-ft)
600
500
400
300
200
100
0
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
-10000
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010

Returns and PDSI


IESW007 (Big Wood) - PDSI and Returns over Time
PDSI
Returns (ac-ft)
PDSI
Returns (ac-ft)
8
6
4
2
0
-2
-4
-6
-8
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020


IESW054 (Richfield) - PDSI and Returns over Time
PDSI
Returns (ac-ft)
8
6
4
2
0
-2
-4
-6
-8
70000
60000
50000
40000
30000
20000
10000
0
-10000
1920
1940
1960
1980
2000
2020
PDSI
Returns (ac-ft)

Another option: MATLAB

- Purpose of MATLAB: check for correlations, determine or estimate time lags, filter data
- MATLAB is a numerical computing environment and programming language
  - Allows for matrix manipulation, plotting of functions and data
- Main task: compare monthly data to diversions, PDSI, and precipitation
- Still would need to purchase software

3 Choices with Return Flows

1. Pursue MATLAB in an attempt to better understand return flows → if we get a result (find correlation) then we can attempt to change return flows
2. Pursue MATLAB, but if no correlation is found we could keep the algorithm the same and use MATLAB in the future once more data is available
3. Keep everything the same as it is now (meaning no MATLAB) and just visit return flow talk again with the next version of the model

QUESTIONS?